ELIMINATING AUTOMOBILE EXHAUST FUMES

By JOHN H. CRANKSHAW

A LITTLE more than eighteen months ago I had occasion to inspect a certain device for eliminating exhaust fumes, being used by the Boston Elevated Railway (Boston, Mass.) on their busses. As a result, I became very much interested in it, and through the kind assistance of Mr. R. D. Boyer, Manager of Plants and Equipment of Hathaway Bakeries, Inc., of Cambridge, Mass., I was able to do considerable experimental work along this line.

In the case of the Boston Elevated Railway, the system includes several closed bus stations whose air conditions were rendered unfit by the accumulation of carbon monoxide and other exhaust gases, generated by busses coasting into the station while using the motor as a brake. The board of health, having received further complaints from thickly settled districts where busses had to descend long hills with a closed throttle, made it clear to the operators that something would have to be done to eliminate this health problem.

The most salient feature of the problem was the fact that practically all obnoxious fumes were formed when the relative speeds of the vehicle and its motor were such that the vehicle was driving the motor, or when the motor was rapidly decelerated. Thus, the problem was confined to the time between gear shifts, and when the vehicle was slowed down with a closed throttle, the motor being driven by the momentum of the vehicle.

The device developed to minimize the formation of exhaust gases consists of a die casting in which is fitted a magnetically operated butterfly valve, whose size is as near that of the internal diameter of the intake manifold as is convenient. This valve, when open, permits air to enter the manifold in place of the gas mixture from the carburetor. It is attached at some point on the intake manifold, preferably near one end, and its opening is caused by the energization of the magnets, while an interruption of the circuit allows a spring to snap it closed.

In the ordinary generator circuit of a bus or automobile, a relay (a type of circuit-breaker) is wired in series with the wire running from the generator to the battery. When the generator is charging sufficiently, the relay closes and allows the current to charge the battery. However, the real function of the relay is to open, thus breaking the circuit, when the generator current falls below a certain point. This prevents battery current from backing up to the generator and attempting to drive it as a motor.

In this device a second relay is inserted in series with the first, and a wire from between the two leads to one pole of the valve. The purpose of the second relay is to prevent operation of the valve by battery current, while the first breaks the circuit between the generator and the valve when the motor comes down to idling speed.

A second wire leads from the other pole of the valve to a suitable ground switch, operated by the throttle in such a manner that closing of the throttle closes the switch, while opening the throttle the least amount opens the switch, also.

Let us suppose, for the moment, that the vehicle is standing still with the motor idling. In order to have the valve open, both the relay and ground switches must be closed. However, although the ground switch is closed at this time (since the throttle is closed), the generator relays are open, and thus, the valve remains closed.

When the driver shifts to first speed and accelerates, the relays close with the increased motor speed, but the throttle has been opened and therefore, since the ground switch is open, the valve remains closed. After acceleration in first speed, the driver closes the throttle to shift to second speed. His action closes the ground switch, and since the motor is above idling speed, the relays are closed and the valve opens, allowing a large quantity of air to enter the intake manifold. In fact, the quantity is so great that the vacuum in the manifold, ordinarily high at this time, is reduced to a point where it can no longer lift gasoline from the carburetor. The result is that instead of half-burned gasoline, fumes and smoke issuing from the exhaust pipe, they are replaced by comparatively pure air.

This operation is repeated each time the driver shifts gears or decelerates with a closed throttle without disengaging the clutch. In the latter case, the valve remains open until either the driver opens the throttle again, or the car slows down to idling speed when the relays open, the valve closes and the motor resumes normal operation.

In early experiments it was found that when the valve opened, the first air to enter leaned out the mixture then in the manifold, and caused a forward surge of power before the motor was starved completely by excess air. This difficulty was surmounted by the use of a magnetically operated circuit-breaker in the ignition circuit, whose function was to break the ignition circuit at the same instant that the valve opened, thus preventing the occurrence of the "surging effect." Any possible backfiring tendencies were corrected by a simple carburetor adjustment.

Unlike so many "gadgets," this device, while ac-

complishing the object for which it was designed, does not affect normal operation of the motor at all, since it operates only when the motor is not being used as a source of power, and as long as the throttle is open and the motor is driving the vehicle, the valve is closed and has no effect.

Although its primary purpose is to eliminate exhaust gases, the "De-Gaser," as it is called, benefits gasoline economy for, during the time that the valve is open, the vacuum in the manifold is very low and little gasoline can be drawn from the carburetor. A considerable further monetary saving is noted in oil consumption, since the high vacuum that would ordinarily exist in the cylinders when the motor is decelerated (due to insufficient mixture supply with a closed throttle) is replaced by a slight compression (incoming air fills each cylinder—just as if the throttle were wide open), forcing the oil back into the crank-case. In an oil-pumping motor used on frequent start-stop service (such as a bus which, in downtown districts, spends almost as much time decelerating as in accelerating) this saving can be an important factor.

Judging from my experience in making and testing these devices, I have come to the conclusion that the device must be made an integral part of the motor to obtain the best efficiency. Further, since butterfly valves are difficult to make sufficiently air-tight, some other type of valve might be more suitable. In any case, I believe that, all other things being equal, the future will bring greater and greater popularity to the idea from an economical as well as a health standpoint.